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Fear of blushing: fearful preoccupation irrespective of facial coloration

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Abstract

Women, with high ($n = 29$) and low ($n = 28$) fear of blushing, were exposed to a mild social stressor (watching a television test card in the presence of two male confederates) and to an intense social stressor (watching their own prerecorded 'sing' video, in the presence of two male confederates). Facial coloration and facial temperature were measured and participants rated their own blush intensity. No differences in actual blushing emerged between both groups. Meanwhile, high fearful individuals' self-reported blush intensity was significantly higher than that of low fearful individuals. Thus, fear of blushing seems to reflect a fearful preoccupation, irrespective of *differential* facial coloration. The present findings concord with cognitive models of social phobia. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Blushing; Fear of blushing; Physiology; Cheek coloration

1. Introduction

Although blushing is a very common emotional response, the majority of people consider blushing as a highly undesirable reaction (Shields, Mallory & Simon, 1990). Some individuals even experience so much distress as a result of blushing that they develop a blushing phobia and seek treatment (Scholing & Emmelkamp, 1993; Bögels, Mulkens & de Jong, 1997). One of the factors that may facilitate the acquisition and maintenance of such a phobia is individuals' blushing propensity. In line with this, it has been demonstrated that self-reported fear of blushing is associated with self-reported blushing propensity, as indexed with the Blushing Propensity Scale (BPS; Bögels, Alberts & de Jong, 1996).

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Apart from a relatively low threshold for blushing, attentional processes may also play a role in this respect. Germane to this possibility, several theorists have mentioned attentional processes as central complicating factors for social phobics who are in a social situation (Daly, Vangelisti & Lawrence, 1989; Hope, Gansler & Heimberg, 1989; Clark & Wells, 1995). That is, interpersonal situations seem to result in heightened self-focused attention (SFA) (Hartman, 1983; Woody, 1996), which, in turn, is assumed to intensify the individual's negative emotional state as well as the perception of their physiological responses (Hope et al., 1989; Bögels et al., 1997; Wells, White & Carter, 1997). The perception of the physiological responses, in its turn, is likely to further enhance the individual's SFA, etc. Pertinent to this suggestion, it has been found that salient physiological arousal serves to focus attention inward (Fenigstein & Carver, 1978; Wegner & Giuliano, 1980), which, in turn, was found to increase individuals' awareness of physiological reactions (see Scheier, Carver & Matthews (1983) for a review). Because blushing is an especially salient physiological reaction (warm cheeks), these processes may be especially prominent in social phobics with fear of blushing as the predominant complaint. Its (presumed) visibility is likely to add further to the SFA eliciting properties of the blush response.

Thus, people with fear of blushing seem to be caught in a vicious circle in which fear of blushing leads to heightened SFA, which increases the awareness of the blush, resulting in a further increase of fear of blushing, etc. Following this, attentional processes may well lead to an overestimation of the actual blush response, which in turn is likely to perpetuate blushing phobics' fear of blushing (cf. McEwan & Devins, 1983).

The present study was designed to investigate further the alleged role of blushing propensity and the overestimation of facial coloration in fear of blushing. Therefore, we exposed individuals with high and low fear of blushing to social predicaments of low and high intensity. Meanwhile, we assessed facial coloration by means of a photoplethysmograph device. Photoplethysmography has been shown to be a reliable and valid method to measure facial blushing (Shearn, Bergman, Hill, Abel & Hinds, 1990, 1992; Mulkens, de Jong & Bögels, 1997). In addition, we recorded temperature changes of the cheek which are thought to serve as interoceptive cues of facial blushing. This was done to investigate possible differential blushing propensity at the interoceptive level, irrespective of its visibility. Furthermore, we recorded changes in skin conductance level as a correlate of general arousal. Finally, participants indicated their own blush intensity, to explore potential differences between high and low fearful individuals with regard to the perceived intensity of their blush response.

The intense social predicament consisted of the individual's watching of her own, prerecorded 'sing' video, in the presence of two male confederates. As previous research clearly showed that virtually all people display some facial coloration under such conditions (cf. Shearn et al., 1990), it might be that the 'sing' manipulation is too strong to detect subtle between group differences with regard to individuals' blushing propensity. Therefore, we also included a relatively mild social stressor in the present study. The mild stressor consisted of the participants watching a television test card in the presence of two male confederates. As this is a rather unusual activity, it was expected to cause slight feelings of uneasiness, but not extreme discomfort.

2. Method

2.1. Participants

Prior to the experiment, 319 female undergraduate students from Maastricht University completed the 'fear of blushing' subscale of the Blushing, Trembling and Sweating Questionnaire (BTS-Q; Bögels & Reith, in press). From this sample, 57 women were selected on the basis of their scores on this subscale. To create two extreme groups, only women with the most extreme scores in the lowest and highest third of the distribution were randomly approached by phone and invited to participate. Virtually all individuals who were reached, agreed to participate in the experiment.

Participants were 28 women with low fear of blushing and 29 women with high fear of blushing. Mean scores of women with low and high fear of blushing were 3.8 (S.D. 2.6; range 0–8.8) and 45.1 (S.D. 12.0; range 30.4–81.0), respectively. The scores of the high fearful group were considerably higher than those of the general population (22.0 (S.D. 17.0); Bögels et al., 1996); yet, the scores were still lower than those of a treatment-seeking group (66.0 (S.D. 26.0); Bögels & Reith, in press). Mean Fear Questionnaire-Social Phobia scores (FQ; Marks & Mathews, 1979) of the high and low fearful women were 16.8 (S.D. 7.2) and 10.2 (S.D. 5.4), respectively. Mean BPS scores of the high and low fearful women were 43.4 (S.D. 10.1) and 22.1 (S.D. 13.7), respectively. Mean age of low fearful individuals was 19.5 years (S.D. 1.67; range 18–24), while high fearful individuals were slightly younger, mean age 19.0 years (S.D. 0.82; range 18–21). Individuals received a small financial compensation for their participation.

2.2. Assessment

Participants completed the BTS-Q and the Blushing Propensity Scale (BPS; Bögels et al., 1996). The BTS-Q subscale 'fear of blushing' consists of five visual analog scales (VASs), ranging from 'not at all' (0) to 'very much' (100). The score of this subscale is derived by averaging scores over the five items. This subscale includes the following questions: "How afraid are you to start blushing?", "How afraid are you while you blush?", "To what extent are you hindered in your daily functioning by blushing?", "How often do you think in a certain situation: I hope I'm not going to blush?" and "To what extent do you avoid situations in which you are likely to blush, or do you avoid others noticing that you blush?" Research concerning the psychometric properties of the BTS-Q indicates that it is a highly reliable instrument. The internal homogeneity of the subscale is high (Cronbach's $\alpha = 0.95$). In addition, the subscale intercorrelates with the Dutch Social Phobia and Anxiety Inventory (SPAI-N; Scholing, Bögels & van Velzen, 1995) ($r = 0.71$) and with the Dutch BPS ($r = 0.56$). Furthermore, the BTS-Q has good discriminant validity; it is able to discriminate not only social phobics from controls, but also social phobics with fear of bodily symptoms like blushing from social phobics without such fears (Bögels & Reith, in press).

The BPS originally consisted of 14 circumscribed social situations for each of which respondents have to indicate how often they feel themselves blushing (Leary & Meadows, 1991). In the Dutch version (Bögels et al., 1996), five items were added to the original version, in order to cover a wider range of situations in which people tend to blush. Answers range

from '0' ("I never feel myself blushing in that situation") to '4' ("I always feel myself blushing in that situation"). The internal consistency of the Dutch BPS is high (Cronbach's $\alpha = 0.92$; (Bögels et al., 1996), as is its test–retest reliability ($r = 0.93$, $n = 53$; Mulkens et al., 1997).

2.3. Apparatus and stimulus materials

Cheek coloration was recorded from a HP model 15230A plethysmograph transducer that was modified in such a way that it was dc coupled rather than ac coupled. Cheek temperature was assessed by means of a temperature dependent resistor (PT100) that was dc coupled. Skin conductance level was recorded from two Beckman Ag–AgCl electrodes (8 mm diameter), placed on the medial phalanges of the middle finger and ring finger of participants' nondominant hand, using the method of constant voltage (0.5 V). The electrodes were filled with an isotonic paste and connected to a Beckman skin conductance coupler (type 9844). All physiological signals were sampled with a frequency of 1000 Hz by a Compaq 486 (33 MHz) computer.

Two different types of videotapes were used: a neutral baseline video (i.e. a steady television test card), and a video displaying the individual's singing, recorded during the first session. The videotapes were presented in the following (fixed) order: 5 min of neutral baseline material (phase 1: baseline I), 1 min of neutral baseline material that was presented in the presence of two male confederates (phase 2: mild stressor), 5 min of neutral baseline material (phase 3: baseline II), approximately 1 min 'sing video', presented in the presence of the same confederates (phase 4: intense stressor). The fixed order from mild to intense social stressor was chosen to minimalize possible psychological and physiological carry-over effects.

2.4. Procedure

On the first day of the experiment the participants were asked to stand in front of both the video camera and the experimenter, and sing 'Happy Birthday' using facial and bodily expressions as much as possible. After that, participants completed some 'phoney' questionnaires, in order to cover the real aim of the study. After this session, appointments were made for the second session, which was introduced as 'just another experiment'.

During the second session, which was at least 1 day and at most 14 days after the first session, participants were asked to sit in a chair at a table in front of a television set. A photoplethysmograph probe was attached to the left cheek and a temperature probe to the right cheek of the individual. Next, skin conductance electrodes were placed. Participants were not informed about the material they were going to watch. The women were only instructed to watch the television screen and to move as little as possible. If the participants talked to the experimenters during the experiment, they responded in a neutral manner.

During baseline I, the individual was alone in the room and watched the silent, steady television test card. After that, the participant judged her blush intensity using 100 mm Visual Analog Scales (VASs). As a manipulation check, she also rated how afraid she had been to start blushing, and how anxious she had felt. Then, the experimenter introduced two male confederates ("during the next fragment, these two people will sit here and join you, while watching") who were seated to the side, between the participant and the television set. After

that, the experimenter left the room, whereafter the participant and the two confederates watched the silent, steady television test card together for 1 min. The confederates were recruited from a pool of nine staff members of our department and were instructed to watch the tv screen and the participant, alternately, and to behave in a neutral fashion. If the participant talked to the confederates, they were instructed to react in a short and neutral manner. Afterwards, the confederates were asked to judge the individual's blush intensity on a VAS (as a rough additional indication of the individual's blush behavior). In addition, the individual completed the three VASs again.

The procedure of baseline II was identical to the first. Finally, the intense social stressor was administered (note that at this stage participants were still unaware that they were going to watch their prerecorded 'sing' video). Afterwards, the two confederates rated the individual's blush intensity; the individual herself completed the same three VASs once more.

2.5. Data reduction

All physiological parameters were analyzed off-line by means of a specifically designed computer program. For both baseline phases of the experiment, mean responses for all three physiological parameters were calculated by averaging the values that were obtained every 30 s. For both social predicaments, peak levels for all three physiological parameters were taken (cf. Shearn et al., 1990, 1992). Next, difference scores were calculated between the mean level during baseline I and the peak level during the mild social stressor as well as between the mean level in baseline II and the peak level during the intense social stressor. Thus, two difference scores were obtained. Likewise, difference scores were calculated for self-reported blush intensity, fear of blushing and fear. These difference scores were computed to compare the individuals' responsiveness during both types of stressors. The interrater agreement of the confederates' judgements about the individuals' blush intensity was computed. During the mild social stressor, the correlation between the two raters was only 0.43. For the intense social stressor, interrater agreement was also below conventional levels of reliability ($r = 0.56$). Therefore, it was decided not to take the confederates' judgements into account in this study.

The difference scores of all physiological and subjective measures (i.e. self-reported blush intensity, fear of blushing and fear) were subjected to separate analyses of variance (ANOVA) with one between-subjects factors (group: high vs low fear of blushing) and one within-subjects factor (manipulation) with two repeated measures (mild social stressor vs intense social stressor).

A manipulation check, using the obtained difference scores on subjective fear and fear of blushing, was conducted in order to test whether the manipulation successfully produced the expected effects with regard to these variables. The manipulation was considered successful when: (a) high fearful individuals reported stronger increases in level of subjective fear and of fear of blushing than low fearful individuals, during both the interpersonal predicament (mild stressor) and the self-presentational predicament (intense stressor) and (b) high fearful participants reported stronger increases in subjective fear and of fear of blushing during the self-presentational predicament (intense stressor) than during the interpersonal predicament (mild stressor).

3. Results

One woman refused further cooperation after she was instructed to sing 'Happy Birthday' in the first session. Another participant had an epileptic seizure during baseline II, whereafter the procedure was stopped. Due to technical problems, physiological data were not available completely for an additional participant. This is reflected in the degrees of freedom.

3.1. Manipulation check

3.1.1. Self-reported fear

Means and S.D.s are displayed in Table 1. The ANOVA yielded a significant main effect of Group, $F(1, 53) = 18.7$, $p < 0.001$, which indicates greater increases in the level of fear in high fearful individuals. There was also a significant main effect of manipulation, $F(1, 53) = 4.9$, $p < 0.05$, indicating relatively strong increases in fear level during the intense stressor (see also Table 1). Finally, the analysis revealed a significant interaction effect of group and manipulation, $F(1, 53) = 5.6$, $p < 0.05$; inspection of the means indicates that the difference between both groups was relatively large during the more intense social stressor. Post-hoc *t*-tests indicated that in both manipulations, the increase of high fearful individuals' self-reported fear differed significantly from that of low fearful individuals ($t(53) = 2.5$, $p < 0.05$, means for

Table 1
Mean values (and S.D.s) of participants with high and low fear of blushing on all physiological measures and self-report measures, during baselines and both manipulations

Variables	High fearful		Low fearful	
	Baseline	Stressor[b]	Baseline	Stressor[b]
Mild manipulation (test card + confederates)				
Coloration (V)[a]	1.04 (.05)	1.13 (.07)	1.06 (.04)	1.16(.06)
Temperature (°C)	30.11 (1.75)	30.71 (1.55)	30.28 (1.59)	31.10 (1.48)
SCL (μmho)	2.23 (1.53)	3.50 (1.85)	1.96 (1.14)	3.29 (1.46)
Subjective blush intensity	15 (18)	37 (27)	3 (3)	17 (17)
Fear of blushing	23 (25)	47 (29)	4 (6)	17 (15)
Subjective fear	13 (15)	34 (26)	3 (5)	11 (15)
Intense manipulation ('sing' video + confederates)				
Coloration (V)[a]	1.08 (.08)	1.19 (.09)	1.10 (.06)	1.21 (.07)
Temperature (°C)	31.04 (1.47)	31.27 (1.37)	31.34 (1.36)	31.52 (1.28)
SCL (μmho)	2.84 (1.67)	3.84 (1.77)	2.52 (1.36)	3.73 (1.57)
Subjective blush intensity	14 (17)	68 (25)	3 (5)	28 (26)
Fear of blushing	16 (20)	62 (26)	4 (5)	19 (21)
Subjective fear	16 (21)	51 (26)	5 (9)	13 (18)

[a] Coloration values are logarithmically transformed.
[b] For physiological variables (coloration, temperature and skin conductance level), peak levels during the social stressors were taken. Subjective variables (fear of blushing, subjective blush intensity and subjective fear), consisted of only one value.

high and low fearful participants being 20.7 and 7.8, respectively, during the mild stressor; $t(53) = 2.6$, $p < 0.001$, respective means being 34.4 and 7.3 during the intense social stressor). Furthermore, high fearful individuals reported a stronger increase in subjective fear during the intense social stressor than during the mild social stressor, $t(28) = -2.8$, $p < 0.01$ (means being 20.7 and 34.4 for the mild and the intense social stressor, respectively). Low fearful individuals' fear elevations during the intense social stressor were not significantly different from those during the mild social stressor, $t(25) = 0.14$, $p > 0.05$ (means being 7.8 and 7.3 for the mild and the intense social stressor, respectively).

3.1.2. Self-reported fear of blushing

Means and S.D.s are shown in Table 1. The analysis yielded a significant main effect of group, $F(1, 53) = 16.4$, $p < 0.001$, which means that the high fearful group reported being generally more afraid to start blushing than the low fearful group. Furthermore, there was a significant main effect of manipulation, $F(1, 53) = 14.2$, $p < 0.001$, indicating that participants, overall, reported being more afraid to start blushing during the intense social stressor. This difference between high and low fearful participants was particularly pronounced during the intense manipulation, $F(1, 53) = 9.3$, $p < 0.005$ (see also Table 1). Post-hoc t-tests indicated that the difference between high and low fearful individuals in the increase of self-reported fear of blushing was prominent only during the intense social stressor ($t(53) = 1.9$, $p = 0.07$, means for high and low fearful participants being 23.8 and 13.2, respectively, during the mild stressor; $t(53) = 4.8$, $p < 0.001$, respective means being 45.9 and 15.6 during the intense social stressor). Furthermore, high fearful individuals reported a stronger increase in fear of blushing during the intense social stressor than during the mild social stressor, $t(28) = -4.6$, $p < 0.001$ (means being 23.8 and 45.9 for the mild and the intense social stressor, respectively), whereas low fearful individuals' fear elevations during the mild and the intense social stressor remained rather unchanged, $t(25) = -0.5$, $p > 0.05$ (means being 13.2 and 15.6 for the mild and the intense social stressor, respectively).

As the results on subjective fear and fear of blushing are in line with the predetermined criteria, it can be concluded that our manipulation was successful.

3.2. Cheek coloration

Means and S.D.s are depicted in Table 1. To normalize the coloration data, logarithmic transformations were performed. A 2 group (high vs low fear)×2 manipulation (mild vs intense) ANOVA did not reveal a significant main effect of group, $F(1, 52) = 0.1$, indicating that, in general, high and low fearful participants displayed similar blush responses. Yet, in line with the prediction, there was a significant main effect of manipulation, $F(1, 52) = 6.9$, $p < 0.05$. As can be seen in Table 1, this finding indicates that the strongest cheek coloration responses were observed during the intense social stressor. Both groups reacted with comparable degrees of cheek coloration during both social stressors ($F(1, 52) = 0.0$). That is, there was no group×manipulation interaction.

3.3. Cheek temperature

Means and S.D.s are displayed in Table 1. The ANOVA yielded no main effect of Group, $F(1, 52) = 0.9$. Thus, overall, the two groups showed comparable cheek temperature responses. Yet, the analysis yielded a significant main effect of manipulation, $F(1, 52) = 36.4$, $p < 0.001$. As can be seen in Table 1, this finding indicates that the strongest increase in cheek temperature took place during the mild social stressor. There was no significant interaction effect of group and manipulation, $F(1, 52) = 2.3$, $p = 0.13$.

3.4. Skin conductance level

Means and S.D.s are depicted in Table 1. The ANOVA revealed no significant main effect of group ($F(1, 52) = 0.6$). However, there was a significant effect of manipulation ($F(1, 52) = 4.2$, $p = < 0.05$); inspection of the means indicates that the greatest increase in general arousal took place during the mild social stressor. No interaction effect of group and manipulation emerged ($F(1, 52) = 0.6$) with respect to changes in skin conductance level.

3.5. Self-reported blushing

Means and S.D.s are depicted in Table 1. A 2 group (high vs low fear of blushing)×2 manipulation (mild vs intense social stressor) ANOVA revealed a significant main effect of group, $F(1, 53) = 13.7$, $p < 0.005$. Inspection of the means indicates that, overall, high fearful women reported blushing more intensely than low fearful women. Furthermore, there was a significant main effect of manipulation, $F(1, 53) = 49.6$, $p < 0.001$, which indicates that participants, overall, reported blushing more intensely during the intense stressor. Finally, the analysis revealed a significant interaction of group and manipulation, $F(1, 53) = 10.5$, $p < 0.005$. This finding indicates that the difference between high fearful and low fearful participants was especially pronounced during the intense stressor (see Table 1). Post-hoc *t*-tests indicated that the difference between high and low fearful individuals was not significant during the mild social stressor ($t(53) = 1.7$, $p = 0.1$, means being 21.8 and 13.5, respectively). Meanwhile, the difference between high and low fearful participants did reach significance during the intense social stressor ($t(53) = 4.3$, $p < 0.001$, means being 53.8 and 25.3, respectively).

4. Discussion

The main results of this study can be summarized as follows: (1) Physiological indices of blushing (i.e. blood pooling and cheek temperature) indicated that individuals with high and low fear of blushing responded with equally intense blush responses. (2) For both groups, these responses (i.e. cheek coloration) were significantly higher during the intense social stressor than during the mild social stressor. (3) With respect to self-reports, however, women high in fear of blushing reported that they blushed far more intensely than low fearful participants.

Self-reports of subjective fear and fear of blushing were higher during the intense social stressor than during the mild social stressor for high fearful individuals. Furthermore, high fearful participants' self-reports with regard to these variables were significantly higher than those of low fearful participants. Besides, physiological indices of blushing (i.e. cheek coloration) were higher during the intense social stressor than during the mild social stressor. Taken together, these findings suggest that the experimental manipulation was successful. In contrast to the other indices of blushing, the rise of participants' facial temperature was especially pronounced during the (first) mild social stressor. The relatively small increase as a result of the intense social stressor may be due to the fact that the cheek temperature was still rising during baseline II. Note that, compared to the blood pooling of the cheek, the skin temperature is a slow response system (e.g. Shearn et al., 1990). This is mainly due to the fact that the skin is a bad heat conductor and therefore acts as a thermo-protector (Guyton & Hall, 1996). As the temperature had not yet stabilized during baseline II, the increase from baseline II to the intense stressor is likely to underestimate the actual impact of the self-presentational predicament on the individual's cheek temperature (cf. Shearn et al., 1990).

For both manipulations, physiologically assessed blush behavior was very similar across both groups. Thus, in contrast to the idea that blushing phobics are characterized by a high blushing propensity, the present data provide no evidence for a relatively low threshold for blushing, nor for a relatively intense blush response in high fearful individuals.

Interestingly, although no differences emerged at the physiological level, high fearful participants strongly differed from low fearful individuals at the subjective level. That is, high fearful women reported that they blushed far more intensely than low fearful women. This difference between high and low fearful individuals does not seem to be attributable to relatively strong interoceptive cues. That is, not only the increase of individuals' facial coloration, but also the increase of individuals' cheek temperature as a function of both manipulations was very similar for both groups. The differences in self-reports between high and low fearful women appeared neither due to differences in general level of arousal (as indexed by the skin conductance level). Thus, taken together, the relatively high self-reported blush intensity of high fearful participants does not seem to arise from hyperresponsive physiological mechanisms. In a similar vein, the relatively high scores on the BPS of the high fearful individuals may reflect a relative overestimation of their actual blushing frequency compared to the low fearful individuals.

Taken together, the present results cast doubt on the idea that high blushing propensity plays an important role in blushing phobia. Meanwhile, the present findings fit comfortably within cognitive explanations of blushing phobia. Note that recent cognitive explanations suggest that attentional processes result in social phobics' being overly preoccupied with aspects of their appearance (e.g. Clark & Wells, 1995). In addition, these explanations suggest that social phobics process 'the self as a social object', which, in turn, enhances the awareness of feared anxiety responses. Both mechanisms are likely to inflate the perception of pertinent physiological symptoms (e.g. Hope et al., 1989). Thus, such a cognitive account of blushing phobia would indeed predict the present finding that high fearful individuals relatively overestimate their blush response as compared to low fearful individuals.

In sum, the present data undermine the view that a relatively low threshold for blushing or a relatively intense coloration in response to a certain social stressor plays an important role in

blushing phobia. Rather, it appears that fear of blushing is fueled by mechanisms that are irrespective of actual facial coloration (e.g. heightened self-focused attention).

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